

BAY AREA

2004 OZONE STRATEGY

APPENDIX E - FURTHER STUDY MEASURE DESCRIPTIONS

DRAFT

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APPENDIX E - FURTHER STUDY MEASURE DESCRIPTIONS

TABLE OF CONTENTS

Further Study Measure FS 1: ADHESIVES AND SEALANTS	3
Further Study Measure FS 2: ARCHITECTURAL COATINGS	4
Further Study Measure FS 3: COMMERCIAL CHARBROILERS	5
Further Study Measure FS 4: COMPOSTING OPERATIONS	6
Further Study Measure FS 5: FOOD PRODUCT MANUFACTURING AND PROCESSING	6
Further Study Measure FS 6: LIVESTOCK WASTE	7
Further Study Measure FS 7: LIMITATIONS ON SOLVENTS BASED ON RELATIVE REACTIVITY	8
Further Study Measure FS 8: SOLVENT CLEANING AND DEGREASING	9
Further Study Measure FS 9: EMISSIONS FROM COOLING TOWERS	11
Further Study Measure FS 10: REFINERY WASTEWATER TREATMENT SYSTEMS	11
Further Study Measure FS 11: VACUUM TRUCKS	12
Further Study Measure FS 12: VALVES AND FLANGES	13
Further Study Measure FS 13: WASTEWATER FROM COKE CUTTING OPERATIONS	13
Further Study Measure FS 14: DEVELOP CUMULATIVE IMPACTS ANALYSIS	14
Further Study Measure FS 15: NOx REDUCTIONS FROM REFINERY BOILERS	15
Further Study Measure FS 16: STATIONARY INTERNAL COMBUSTION ENGINES	16
Further Study Measure FS 17: ENCOURAGE ALTERNATIVE DIESEL FUELS	18
Further Study Measure FS 18: MITIGATION FEE PROGRAM FOR FEDERAL SOURCES	19
Further Study Measure FS 19: INDIRECT SOURCE MITIGATION PROGRAM	19
Further Study Measure FS 20: FREE TRANSIT ON SPARE THE AIR DAYS	20
Further Study Measure FS 21: EPISODIC MEASURES	21

FURTHER STUDY MEASURE FS 1: ADHESIVES AND SEALANTS

Further Study Measure Description

In 2003 and early 2004, the ARB, San Joaquin, Sacramento and Bay Area districts jointly undertook a rule comparison project for a number of source categories, including adhesives and sealants. The South Coast AQMD rule for adhesives appears to be the most stringent, particularly for architectural adhesives. Architectural adhesives encompasses a wide variety of adhesives used in residential and commercial construction: carpet adhesives, flooring adhesives, subfloor adhesives, tile adhesives, drywall adhesives, and multipurpose construction adhesives. The South Coast VOC limits range from 50 to 150 grams per liter (g/l) for various categories of architectural adhesives.

In 1998, the ARB and California districts developed Reasonably Available Control Technology/Best Available Retrofit Control Technology (RACT/BARCT) VOC limits for adhesives and sealants. RACT/BARCT VOC limits range from 100 to 250 g/l for various categories of architectural adhesives. The Bay Area rule, Regulation 8, Rule 51: Adhesive and Sealant Products, meets the BARCT limits in the ARB document.

Generally, most adhesive and sealant products that meet the RACT/BARCT limits will also meet the SCAQMD limits. VOC content for these products is dictated by formulation technology. Solvent-based products generally have a VOC content of 300-400 g/l, and water-based products generally have a VOC content of 0-50 g/l. Reducing the VOC limits in rules will have little effect because most currently available solvent-based products do not comply with either set of limits, and most water-based products comply with both sets of limits, so reducing the allowable VOC limits would not produce any emission reductions. A small subset of architectural adhesives are solvent-based products that have VOC contents in the 100-150 g/l liter range. These products generally use a mixture of water and hydrocarbon solvents and were typically formulated to meet the California RACT/BARCT limits.

The largest category of architectural adhesives is subfloor adhesives formulated with solvent to allow bonding to wet or frozen lumber. These products meet the BAAQMD and BARCT VOC limit of 200 g/l. However, they would not comply with the South Coast AQMD limit of 50 g/l. In California, most wood frame construction relies upon green (wet) lumber. The South Coast 2000 staff reports states that the lower limits are feasible because of the warm climate of the Los Angeles area. The report also notes that relatively low-VOC polyurethane adhesives can bond wet and frozen lumber but fails to discuss the role of isocyanates from polyurethanes in allergic sensitization and asthma. In areas outside the Los Angeles basin, lower temperatures and higher humidity will cause curing difficulties for products meeting the SCAQMD limits. Consequently, a 50 g/l VOC limit for the Bay Area is not feasible.

In the rule comparison discussions, significant differences in inventory between the districts emerged. Specifically, the San Joaquin District has almost no area source adhesive emissions, which includes the architectural adhesives, whereas the Bay Area inventory has over 9 tons organic emissions per day from area source adhesives. When Bay Area staff developed Regulation 8, Rule 51: Adhesives and Sealants, the area source inventory was derived from the Rauch Guide to the US Adhesives and Sealants Industry, by the Rauch Associates, Inc., originally the 1990 edition. The Rauch Guide

breaks down adhesives and sealants into nine categories, which allows some categories to be eliminated because they are either consumer uses and likely subject to the ARB's consumer products standards, or used in sources that require a permit and would be included in the point source inventory. From the US totals, the Bay Area population percentage and control factors based on the rule requirements are applied to produce an area source inventory. Because of the discrepancy between inventories, joint further study among districts is recommended to reconcile these differences.

References

California Air Resources Board. 1998. "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Adhesives and Sealants." Koressel, T., Charles McMurray Co. 2003. Personal communication.
South Coast AQMD. 2002. "Final Staff Report: Proposed Amended Rule 1168-Adhesives and Sealants"
South Coast AQMD. 2000. "Staff Report: Proposed Amended Rule 1168-Adhesives and Sealant Applications"
TIAX. 2003. Sacramento Regional Clean Air Plan Update: Control Measure D3.
Walnut, F., TACC International. 2003. Personal Communication.

FURTHER STUDY MEASURE FS 2: ARCHITECTURAL COATINGS

Further Study Measure Description

The District amended Regulation 8, Rule 3: Architectural Coatings in 2001 based on the CARB Suggested Control Measure (SCM) for Architectural Coatings (June, 2000). The SCM was the product of nationwide surveys of available coatings conducted by CARB and discussion among districts, architectural and industrial maintenance coatings manufacturers, infrastructure owners and painting contractors. The Sacramento district was the first district to adopt amendments in June 2001, and the Bay Area adopted amendments in November 2001.

The development of the SCM on which the amendments were based was directed by the California Air Pollution Control Officers Association (CAPCOA). CAPCOA further directed that CARB and the districts evaluate South Coast's future (later than 2004) VOC limits and/or other limits to achieve the maximum possible reductions from the architectural coatings category. CARB is currently evaluating new survey data, and investigating feasible VOC standards both on a mass basis and also on a reactivity basis following the same CARB/districts workgroup format. Districts are awaiting the results of the CARB surveys and data analysis and will work together to develop future reductions in VOC emissions from architectural coatings. The CARB/districts efforts are expected to be completed in 2005.

References

CAPCOA Statement of Principles and Positions on Architectural Coatings Regulations (10/28/99)
SCAQMD Rule 1113: Architectural Coatings

FURTHER STUDY MEASURE FS 3: COMMERCIAL CHARBROILERS

Further Study Measure Description

In 1997, the South Coast AQMD adopted Rule 1138: Control of Emissions from Restaurant Operations. Rule 1138 requires that chain driven charbroilers install catalytic oxidation equipment to control emissions. The catalytic oxidizers control particulate matter and volatile organic compounds that are emitted from the cooking process. The South Coast determined that chain driven charbroilers to be the only type of restaurant operation for which control is cost effective, although further research is being conducted on under-fire charbroilers. In 2002, the San Joaquin Valley adopted Rule 4692: Commercial Charbroiling. Both rules have the same exemption criteria: charbroilers that cook less than 875 lbs of meat per week or emit less than 1 lb of emissions per day are not subject to the rule.

The South Coast originally projected a cost effectiveness for this control measure of \$4650 per ton for a combination of VOC and particulate matter. More recently, the San Joaquin APCD estimated a cost effectiveness of \$3070 per ton combined VOC and PM reduced. However, for VOC alone, the cost effectiveness rises to \$13,070. The South Coast assumed a control effectiveness of 90% and the San Joaquin APCD used figures for control efficiency of 83% and 86% for PM and VOC, respectively. Some additional research indicates that the emission reductions may be closer to 62%, which would raise the cost of pollutants reduced per ton 38%.

The current inventory for VOC emissions from all cooking operations in the Bay Area is 1.29 tons/day. Of that, based on a population-weighted comparison between the Bay Area and the San Joaquin Districts, emissions estimates from chain driven charbroilers are 0.08 tons/day VOC and 0.26 tons/day PM. A comparable rule would reduce emissions by 0.066 tons/day VOC and 0.22 tons/day PM. This is a de minimis amount for VOC alone.

This control measure may not be justified for VOC alone, however, considering the potential to control particulate matter, it may be justified. Also, the South Coast's efforts regarding under-fire charbroilers, scheduled to be completed this year, may increase the potential emission reductions.

References

South Coast Rule 1138: Control of Emissions from Restaurant Operations and staff report, 11/7/1997, SCAQMD
San Joaquin Rule 4692: Commercial Charbroiling and staff report, 3/21/2002, SJVAPCD

FURTHER STUDY MEASURE FS 4: COMPOSTING OPERATIONS

Further Study Measure Description

In January, 2003 the South Coast AQMD adopted Rule 1133.2: Emission Reductions from Co-composting Operations, to limit emissions of both VOC and ammonia. Co-composting is the mixing of biosolids or manure with bulking agents to produce compost. Rule 1133.2 requires new co-composting operations to be enclosed and emissions controlled by 80%, and existing co-composting operations be enclosed and emissions controlled by 70%. Existing operations are given compliance dates between 2007 and 2009, depending on throughput capacity. The rule does not apply to agricultural composting, greenwaste (gardening, agriculture and landscaping) composting, woodwaste composting, co-composting operations of less than 1,000 tons throughput per year or 35,000 tons per year throughput if no more than 20% biosolids. The rule is expected to reduce the South Coast composting emissions by 17.6%.

The Bay Area does not have a specific category in the emission inventory for composting or greenwaste. Emissions are included within the category of "waste management, landfills, point or area sources" or "waste management, other." The Bay Area requires a permit of a composting facility that processes 500 tons/year, lower than the South Coast exemption level for Rule 1133.2. The source code assigned to these operations varies, making an emissions estimate based on permitted sources uncertain. Based on the South Coast control measure and rule development staff report, the Bay Area inventory for composting operations is about 3.4 tons/day VOC and 2.35 tons/day ammonia (South Coast inventory numbers * 0.5). Consequently, this measure applied to the Bay Area would be expected to reduce VOC emissions by 0.6 tons/day.

The South Coast Rule 1133.2 staff report indicates that the cost effectiveness for this rule ranges from \$8700 to \$10,000 per ton of ammonia and VOC reduced and from \$23,000 to \$26,500 per ton of VOC reduced. This is not very cost effective compared to most Bay Area rules for VOC, but within the range of acceptable costs for VOC and ammonia combined. However, as the South Coast AQMD gains experience in implementation of this rule, cost effectiveness may be found to be less. Also, additional benefits of particulate control from the reductions in ammonia (which reacts to form secondary particles) may make the cost effectiveness more attractive as a particulate control measure.

References

SCAQMD Rule 1133.2: Emission Reductions from Co-composting Operations and staff report, Jan. 10, 2003

FURTHER STUDY MEASURE FS 5: FOOD PRODUCT MANUFACTURING AND PROCESSING

Further Study Measure Description

The South Coast AQMD adopted Rule 1131: Food Product Manufacturing and Processing Operations, in September, 2000. The rule addresses any facility that emits

more than 440 pounds of organic compound emissions per month that produces, formulates or configures food or food products, including spices, extracts, flavorings and colorings. Bakeries, wineries and breweries are not subject to the rule. VOC emitting processes found in food product manufacturing include distillation, extraction, reaction, blending, drying, crystallization, separation, granulation, filtration and extrusion. The South Coast rule limits solvents used in food processing to 120 grams VOC/liter or requires capture and control of emissions. Solvent used for sterilization of food products is limited to 400 grams VOC/liter and, after 2005, 200 grams VOC/liter.

The South Coast rule projects an emission reduction of about 2 tons from an inventory of 2.47 tons/day. In the Bay Area, the emissions from food preparation are contained in the emission inventory categories, "Other Food and Agricultural Processing," which includes coffee roasting, grain milling, sugar refining and pet food processing. The emission inventory lists organic emissions from this category at 0.3 tons/day. However, some operations subject to the South Coast rule, such as sterilization, reaction or distillation, may have source codes that put them into other categories in the Bay Area. The South Coast staff report notes that food processing operations were exempt from the South Coast permit system. In the Bay Area, some food processing operations are exempt, including non-restaurant cooking operations of less than 1000 tons per year throughput, dry food milling, grinding, handling and packaging equipment, and small coffee, cocoa and nut roasters. Because other food processing equipment is subject to permit requirements, it may already be controlled, reducing the potential emissions reductions.

Based on the difference between the South Coast emission inventory and the Bay Area emission inventory, the differences in permitting regulations and the possibility that some sources in the Bay Area are already controlled, this measure is recommended for further study.

References

South Coast AQMD Rule 1131: Food Product Manufacturing and Processing Operations, and staff report, September, 2000.

FURTHER STUDY MEASURE FS 6: LIVESTOCK WASTE

Further Study Measure Description

The South Coast AQMD has proposed Rule 1127: Emission Reductions from Livestock Waste, based on control measure WST-01 in their 2003 Air Quality Management Plan. The proposed rule would control emissions from livestock waste (primarily dairies) by requiring wastes to be transported out of the district, controlled in an approved composting operation, processed in a controlled anaerobic digester, or spread on agricultural land approved for the spreading of manure. In 1997, the SCAQMD adopted Rule 1186 that requires livestock operations to take certain measures to reduce particulate matter, but the rule does not address livestock waste. South Coast proposed Rule 1127 is designed to reduce emissions of particulate, ammonia (which forms aerosol particulate matter) and VOC. The measure estimates that a reduction in ammonia of 50% is possible at a cost effectiveness of from \$2000 to \$5000 per ton ammonia. The

ammonia concentration is approximately three times the VOC concentration, so as a VOC only control measure, cost effectiveness would range from \$6000 to \$15,000 per ton.

The Bay Area emission inventory for livestock waste is 29.81 tons/day total organic compounds. Most of that is methane. Reactive organic emissions are 8% of that total, 2.38 tons/day. Of that inventory of emissions from total livestock waste, approximately 13% (0.31 tons/day) is from dairy cattle, the basis of the South Coast measure. The ARB has raised questions about the emissions estimates, so ROG (VOC) emissions may be lower. Accordingly, the capital costs associated with control of VOC emissions would make the measure less cost effective.

The focus of the South Coast measure is to control particulate and ammonia. The measure has more utility for control of particulate and ammonia, a fine particulate precursor, than for VOC, and particularly so in the South Coast where dairy farms are concentrated in an area that is upwind from monitoring stations that record high PM10 levels. The South Coast control measure notes that a decrease in ammonia and VOC emissions of 2 to 3% per year is likely due to the increased urbanization of the region (which will decrease the number of dairies) and water quality control regulations that require manure to be removed from dairies bi-annually, or incorporated into soil at agronomic rates as quickly as possible. In the Bay Area, many farms may already comply with the proposal by segregating waste and incorporating manure into soil at agronomic rates. In addition, incentives already exist to sell electricity generated by a methane digester into the power grid. Any study should investigate these incentives as a cost effective means of control. Due to uncertainty in the VOC inventory for this category, and the cost effectiveness of a command and control measure, this measure is not recommended as a control measure at this time. However, because of the potential particulate matter benefits, it is recommended for further study.

References

"PG&E vs Cow Power Dairy Farmers Say the Utility Opposes Energy from Methane Gas" Martin, Glen, SF Chronicle, June 27, 2004
SCAQMD Final 2003 Air Quality Management Plan, Control Measure #2003 WST-01, SCAQMD, August, 2003
Air Emissions Action Plan For California Dairies, ad hoc Dairy subcommittee of the SJVUAPCD, May, 2003

FURTHER STUDY MEASURE FS 7: LIMITATIONS ON SOLVENTS BASED ON RELATIVE REACTIVITY

Further Study Measure Description

Further Study Measure F8 in the 2000 Clean Air Plan suggested the potential to make regulations more effective by replacing VOC limits, measured in mass VOC per volume of product, with limits based on the relative contribution to ozone formation of each of the organic species that make up the VOC of a product, or the "relative reactivity." This further study measure would examine whether a relative reactivity approach would be

either more cost effective than mass reductions in VOC content or allow reductions where further reductions in mass might not be technically feasible.

The differences in ozone produced by different species of organic compounds have been recognized for many years, however, the ability to quantify the relative contributions to ozone formation of the vast number of organic species has only recently been developed. The California Air Resources Board, working with scientists and representatives of industry and air agencies, have developed a scale of incremental reactivities that is used in their aerosol paint regulation (Regulation for Reducing the Ozone Formed from Aerosol Coating Product Emissions). Currently, CARB staff have requested speciation data for architectural and automotive refinish coatings to consider whether a relative reactivity approach might be advantageous for these two source categories. US EPA staff is involved in CARB's processes to consider relative reactivity based regulations, but they have yet to approve CARB's consumer product rules into the SIP, including the aerosol paint rule. District staff participate in discussions of reactivity as it relates to potential regulatory activity. At this time, however, because the potential for emission reductions (or ozone formation reductions) cannot be assessed for any source category, this control measure is recommended for further study.

References

17 California Code of Regulations, Section 94520, 94700, Regulation for Reducing the Ozone Formed from Aerosol Coating Product Emissions, and Table of Maximum Incremental Reactivity
Further Study Measure 8, 2000 Bay Area Clean Air Plan, BAAQMD, December, 2000

FURTHER STUDY MEASURE FS 8: SOLVENT CLEANING AND DEGREASING

Further Study Measure Description

In 2003 and early 2004, the ARB, San Joaquin, Sacramento and Bay Area districts jointly undertook a rule comparison project for a number of source categories, including solvent cleaning and degreasing. The discussion included vapor degreasing, cold cleaning and wipe cleaning. The joint conclusion was that vapor degreasing, done largely with negligibly photochemically reactive solvents, was not a source category that was likely to produce any significant emissions reductions. Cold cleaning and wipe cleaning are discussed below.

Cold Cleaning

Cold cleaning describes the use of cleaning solution in a tank or container into which a part to be cleaned is immersed, or a remote reservoir cleaner that pumps some cleaning solution over a part to be cleaned that then drains back into the reservoir. All districts except the South Coast have adopted a 50 gram/liter VOC standard for cleaning solutions, and the South Coast has adopted a 25 g/l VOC standard. The South Coast, in adoption of a 50 g/l VOC standard in 1997, used an EPA emission factor of 1.45 pounds VOC/day/cold cleaner. In 2002, the South Coast staff report assumed a 50% reduction in the remaining emissions because of the adoption of a 25 g/l VOC standard.

Bay Area staff believe that the EPA emission factor used by South Coast for rule adoption, and subsequently by other districts for control measures, is too high because it did not account for the low volatility of the mineral spirits blends used in most mineral spirits cold cleaners and remote reservoir cleaners at the time the rule was adopted. In 1998, the Bay Area adopted a 50 g/l VOC standard except for one cold cleaner in each facility. At that time, Bay Area staff estimated emissions from these cleaners based on information provided by the Safety Kleen Corporation, the dominant cold cleaner solvent provider. Emissions were estimated by a mass balance approach, considering 1) the percent market share that Safety Kleen had in 1998; 2) the number of mineral spirit cold cleaners Safety Kleen leased and serviced in the Bay Area; 3) the amount of solvent they supplied and recycled; and; 4) an estimation of the sludge and foreign substance in their return solvent. From that data, we developed an emission factor of 0.6 pounds VOC/day/cold cleaner, significantly less than the 1.45 lb/day factor used by the South Coast and other districts. In 2002, the Bay Area District amended the standards so that all cold cleaners, with some exceptions for specific substrates consistent with other districts, would have to meet the 50 g/l VOC limit.

Using the methodology in the 2002 Bay Area staff report to calculate emissions reductions for a 25 g/l VOC standard, the additional emissions reductions to be gained from a rule amendment would be 0.0743 tons per day, less than de minimis. In addition, the South Coast, in their staff report, estimated that 70% of cleaning solutions available to comply with their 50 g/l VOC standard would also meet their 25 g/l VOC standard. Consequently, the potential emissions reductions would be only 30% of the above total, or 0.022 tons/day. However, because of the discrepancy in how emissions are calculated between districts, joint further study is needed to examine emissions calculations for cold cleaners within California.

Wipe Cleaning

Wipe cleaning involves wetting a rag, cloth or paper with a cleaning solution and wiping grease or soils from a part by hand. The South Coast AQMD adopted a 25 g/l VOC standard for wipe cleaning concurrent with their adoption of a 25 g/l VOC standard for cold cleaning.

In 2002, the Bay Area District amended 5 rules to incorporate a 50 gram/liter VOC standard for wipe cleaning operations. These rules regulate the surface preparation and coating of metal parts, metal furniture and large appliances, plastic parts, marine vessels and general solvent and surface coating.

In calculation of the emissions attributable to wipe cleaning in Bay Area facilities, staff recalculated the emission inventory for area sources because it was developed from 1993 data and did not account for the subsequent impact of the Montreal Protocol on Ozone Depleting Substances and EPA's finding that acetone was a negligibly photochemically reactive. These two factors have led to a surge in the development of water-based cleaning applications, and a shift to the use of solvents such as MEK or alcohol to acetone, significantly reducing reactive organic emissions.

The adoption of a 25 g/l VOC standard for wipe cleaning has been calculated to reduce emissions by 0.0756 tons per day, not including any cleaning solutions that would already meet the 25 g/l standard. If, as South Coast staff estimated for cold cleaners, 70% of the solutions in use already meet a 25 g/l VOC standard, the emissions reductions could be only 0.023 tons per day. This is less than de minimis, however,

further study is needed on a statewide basis to update the study on which the area source inventory was derived.

References

BAAQMD Analysis of SMAQMD Suggested Changes to BAAQMD Rules, attachment to letter, B. Norton to N. Covell, Nov. 12, 2002
South Coast AQMD Proposed Amended Rule 1122 Staff Report, South Coast AQMD, July, 2001
Staff report, Proposed Amendments to Regulation 8, Rules 4, 14, 19, 31, 43, BAAQMD, Oct. 2002
Staff Report, Proposed Amendments to Reg. 8, Rule 16: Solvent Cleaning Operations, BAAQMD, Sept. 2002
Staff Report, Proposed Amendments to Reg. 8, Rule 16: Solvent Cleaning Operations, BAAMQD, Sept. 1998

FURTHER STUDY MEASURE FS 9: EMISSIONS FROM COOLING TOWERS

Further Study Measure Description

The emission inventory for refinery cooling towers shows 0.45 tons/day organic emissions, based on cooling water throughput from cooling towers with District permits. AP-42 emission factors of 6 lbs organic emissions per million gallons water throughput were used in this calculation. This assumes organic compound leaks into the cooling water system are not minimized. However, if leaks are minimized, the AP-42 emission factor is 0.7 lb organic emissions per million gallons water. Further study is needed to determine whether leaks from cooling towers are currently minimized and whether there is any potential for emission reductions from regulations.

References

Compilation of Air Pollution Emission Factors (AP-42), US EPA, 1995

FURTHER STUDY MEASURE FS 10: REFINERY WASTEWATER TREATMENT SYSTEMS

Further Study Measure Description

Emissions from refinery wastewater systems are being studied through further study measure FS-9 from the 2001 Ozone Attainment Plan. Refinery wastewater systems basically consist of collection systems to collect and transport hydrocarbon-containing process water, physical separation systems to separate oil and water by mechanical means, and finally, biological and chemical processes to treat effluent. District staff have completed a study of emissions from the wastewater collection systems and is recommending amendments to Regulation 8, Rule 8: Wastewater (Oil-Water) Separators, to reduce ROG emissions from this portion of the wastewater system. The physical separation systems, including oil-water separators and dissolved air floatation

units, are already controlled by Regulation 8, Rule 8. This further study measure focuses on the effluent treatment systems, including wastewater ponds.

Water entering the treatment systems after physical separation tends to have low organic content, but most of these organic compounds must be removed by biological degradation. Some of these compounds are volatilized and emitted to the atmosphere. Reg 8-8 does not require control of biological or chemical treatment portions of wastewater systems. Water is treated until it meets the San Francisco Bay Regional Water Quality Control Board discharge requirements.

Emissions for one refinery's large treatment pond with a flow rate of 10 million gallons per day have been estimated, using EPA's WATER8 model, to be approximately 150 pounds per day. Total wastewater pond emissions for the Bay Area refineries are currently estimated to be 0.4 tons per day. The current emissions inventory estimates 0.24 tons per day organic emissions for this source category. However, staff believe that better emissions estimates could be made by a combination of sampling and refined models. A study of the emissions from the biological and chemical treatment portion of refinery wastewater systems has been initiated through a cooperative workgroup process that includes refinery personnel, ARB, District and SF Bay Regional Water Quality Control Board staff, environmental groups and consultants with expertise in developing emissions models for wastewater systems.

In addition to organic emissions, odors result when aeration ceases or is insufficient, such as when biological treatment processes are overwhelmed by accident or storm, or when the biota in the treatment process are otherwise disrupted. Considerable research is currently being conducted by universities and other institutions so that the action of treatment pond biota can be better understood and controlled. This research, some of which is being conducted by Lawrence Berkeley Laboratory, holds potential for reducing odors from wastewater ponds. In community meetings held to solicit control measure suggestions, several requests were made to control refinery wastewater treatment ponds. Consequently, the potential for control is recommended for further study.

References

Draft Technical Assessment Document: Potential Control Strategies to Reduce Emissions from Refinery Wastewater Collection and Treatment Systems, CARB and BAAQMD, Jan., 2003

FURTHER STUDY MEASURE FS 11: VACUUM TRUCKS

Further Study Measure Description

This measure was analyzed in the 1994 Clean Air Plan as Control Measure B6: Control of Emissions from Cleaning Up Organic Liquids. The analysis concluded that the measure would not be cost effective. However, in addition to cleaning up spills, vacuum trucks have been observed in frequent use as part of some refinery operations, such as removing water from tank surfaces, cleaning of oil-water separators, and transport of sludges, slop oils and tank bottoms. At one refinery, it was estimated that over

1,000,000 gallons of hydrocarbon containing liquids were put in vacuum trucks per month, which is the equivalent of approximately 145,000 gallons of hydrocarbons per month. On a volume basis, at least 1.5 gallons of air is emitted for every gallon of vacuum tank capacity.

In some cases, emissions from the tanks are controlled by the use of a carbon canister that adsorbs organic vapors as they are emitted from the truck tank, primarily to control odors. Further study can determine the emissions from these activities and whether control of emissions is more cost effective than the 1994 analysis found.

References

1994 Clean Air Plan Control Measure B6: Control of Emissions from Cleaning Up Organic Liquids

FURTHER STUDY MEASURE FS 12: VALVES AND FLANGES

Further Study Measure Description

In 2003 and early 2004, the ARB, San Joaquin, Sacramento and Bay Area districts jointly undertook a rule comparison project for a number of source categories, including valves and flanges. Valves and flanges are typically found at refineries and chemical plants, but also found in other petroleum and gas production facilities. The review found that the Bay Area's existing Regulation 8, Rule 18: Equipment Leaks, is the most stringent regulation in the state. Reg. 8, Rule 18 was amended on January 21, 2004 to fulfill the provisions of control measure SS-16 from the 2001 Ozone Attainment Plan. During the rule development, staff identified a number of different areas for potential future study to further reduce emissions from valves and flanges. These areas include: 1) setting a maximum leak limit for components; 2) targeting minimization and repair periods; 3) accelerating equipment replacement for equipment found leaking frequently; 4) requiring inaccessible equipment to be replaced by superior technologies; 5) quantifying mass emissions and imposing emissions caps; 6) increasing inspection frequencies; and 7) incorporating remote sensing technologies to identify the largest leaking components.

References

Staff Report, Proposed Amendments to Regulation 8, Rule 18: Equipment Leaks, January, 2004, BAAQMD

FURTHER STUDY MEASURE FS 13: WASTEWATER FROM COKE CUTTING OPERATIONS

Further Study Measure Description

Refineries operate high pressure water pumps to remove or "cut" coke from coking drums. During the investigation of Further Study Measure FS 9: Refinery Wastewater

Systems in the 2001 Ozone Plan, it was noted that coke cutting operations at some facilities generated significant quantities of wastewater. This wastewater, at elevated temperatures, is often recycled. The wastewater from coke cutting is not part of the refinery wastewater collection and treatment system. One possible method of control would be to include coke cutting wastewater in the existing collection and treatment system. Additional research needs to be conducted to determine whether coke cutting wastewater contains significant quantities of VOC and whether there is any potential for emissions reductions from these operations. Because of these unknowns, it is recommended that coke cutting operations be studied.

References

Draft Technical Assessment Document: Potential Control Strategies to Reduce Emissions from Refinery Wastewater Collection and Treatment Systems, CARB and BAAQMD, Jan., 2003

FURTHER STUDY MEASURE FS 14: DEVELOP CUMULATIVE IMPACTS ANALYSIS

Further Study Measure Description

This measure focuses on the health risks posed by additional emissions of toxic air contaminants (TAC) in communities exposed to existing sources of TACs, with particular emphasis on the particulate matter emissions from backup diesel generators. To address this risk, the District has requirements in place. The District requires permits for backup generators and any diesel generator must pass a stringent health risk screen. The screening levels are set at extremely low levels to provide a significant margin of safety so that installation of multiple sources in an area should not pose significant risks. This is an "incremental risk" approach. A "cumulative risk" approach would evaluate the aggregate risk from the proposed new source when combined with all existing sources of risk.

A community based cumulative impact analysis (CIA) addressing local air pollution sources can be a difficult technical undertaking due to the diversity and number of sources typically present (e.g., industrial and commercial stationary sources, mobile sources, natural sources, and area-wide sources such as fireplaces and the use of consumer products). These technical difficulties are largely related to incompleteness of data (e.g., spatial and temporal emission patterns) needed to estimate exposures and health risks, and to ascertain source contributions.

In addition to the technical difficulties posed by CIA, including monitoring and modeling, there are also policy issues that need to be addressed before CIA can be used in regulatory programs. Criteria for judging the significance of cumulative health risks would have to be established and would likely be much different than levels considered appropriate for use in judging incremental health risks. This includes both defining adverse cumulative health risk thresholds, and establishing the level at which a proposed source, or group of sources, would be considered to have a significant contribution to that adverse impact.

District staff have conducted a series of community workshops to discuss a “toxics” New Source Review program. The proposal translates existing policies into regulatory language and makes them more stringent, but the program continues to rely on an incremental risk approach.

The District has also budgeted a Community Air Risk Evaluation (CARE) program with emphasis on diesel particulate matter. The elements of this program are to develop a gridded toxic emissions inventory to determine locations with potentially high risk levels for diesel particulate emissions and other toxics emissions. Then, up to two additional particulate and toxics monitors will be added to potentially high risk communities based on the inventory. A pilot cumulative risk assessment for stationary sources, including back up generators, will be prepared and this will ultimately feed into development of control measures to mitigate community risk. This approach will focus on reduction of risks in communities where risk is highest.

References

Approved minutes, Bay Area Air Quality Management District Advisory Council, “Cumulative Impacts Assessment and the Precautionary Principle”, Advisory Council, January 14, 2004.

Bay Area Air Quality Management District Proposed Budget for Fiscal Year 2004 – 2005, April, 2004.

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FURTHER STUDY MEASURE FS 15: NOX REDUCTIONS FROM REFINERY BOILERS

Further Study Measure Description

The measure is based on the San Joaquin Valley Unified APCD’s Rule 4306 – Boilers, Steam Generators, and Process Heaters – Phase 3: a five-ppm NOx limit corrected to 3% O₂, or 0.0062 lb/MMBtu standard for large refinery boilers and process heaters (larger than 110 MMBtu). This limit is much lower than that allowed in Bay Area Regulation 9, Rule 10: Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries. The Bay Area limit of 0.033 lb/MM BTU (approximately 30 ppm) was adopted in 1994. The San Joaquin limit in Rule 4306 was adopted in 2003 and represents the most stringent rule in California.

The Bay Area Rule 9-10 applies only to refinery boiler units. When the rule was adopted, averaging among units was considered the only cost effective way to achieve the regulatory standards. Many of the units are old, low-NOx burner technology did not exist for some, and some are in locations where there is not enough space to add selective catalytic reduction (SCR) units. Newer units, however, are subject to lower BACT limits for NOx and are not part of the average. To properly determine the feasibility and appropriateness of implementing a lower NOx limit on refinery boilers in the Bay Area, at a minimum, several factors need to be evaluated:

- A precise inventory of refinery boilers;

- A determination of the type, age, retrofit ability of; and the nature of the emissions from these boilers;
- The cost effectiveness of retrofits and replacement technologies;
- The contribution to emissions of the boilers that are currently exempt from Rule 9-10; and
- The inventory of non-refinery boilers of similar size in use in the District.

References

San Joaquin Valley Unified APCD Rule 4306 – Boilers, Steam Generators, and Process Heaters – Phase 3.

Staff Report, Regulation 9, Rule 10: Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries.

FURTHER STUDY MEASURE FS 16: STATIONARY INTERNAL COMBUSTION ENGINES

Further Study Measure Description

Gaseous Fuel Fired Engines

The District regulates NO_x emissions from internal combustion engines under Regulation 9, Rule 8, which imposes NO_x limits on engines fired with gaseous fuels. Reg 9-8 was adopted in 1993 pursuant to CARB pollution transport regulations (California Code of Regulations beginning at section 70600). Those regulations required the BAAQMD to adopt by 1994 BARCT for source categories that collectively amounted to 75% of the 1987 nitrogen oxides emission inventory. Because the majority of IC engine emissions came from approximately 60 large engines fired with gaseous fuels located at wastewater treatment facilities, landfills, and refineries, Reg 9-8 imposed controls only on gaseous-fueled engines. Collectively, these engines were estimated to emit 9 tons per day of NO_x, and the rule was estimated to reduce emissions by 8.1 tons per day.

Under Reg 9-8, engines fired with fossil-derived fuels must meet a NO_x limit of 56 ppm if rich burn and 140 ppm if lean burn. (Current BARCT limits would be, respectively, 25 ppm, or alternatively 96% reduction, and 65 ppm, or alternatively 90% reduction.) Engines fired with waste-derived fuel must meet a 140 ppm limit if lean burn and 210 ppm if rich burn. Current BARCT limits would be 65 ppm and 50 ppm respectively, or alternatively, 90% reduction for either. The inventory currently shows that NO_x emissions from stationary IC engines fired with gaseous fuels are 2.37 tons per day, including engines subject to Reg 9-8 as well as smaller engines not subject to the rule. District BACT for engines requires gaseous fuel except where impractical.

Emission reductions from engines fired with gaseous fuels cannot be easily estimated. The CARB BARCT limits include alternative percentage reduction limits that allow compliance through a demonstration that, though an engine may not meet a specified exhaust concentration limit, emissions have been reduced by a specified percentage. Many of the engines are likely to comply with the BARCT alternative percentage reduction requirements so that the BARCT limits would produce no emission reduction.

For other engines, emission reductions cannot be easily estimated: engine-by-engine calculations would be required, and emission reductions may be minor.

Liquid Fuel Fired Engines

NOx emissions from stationary liquid-fueled IC engines in the Bay Area are shown in the most recent BAAQMD inventory to be 4.6 tons per day. Virtually all stationary liquid-fueled engines in the BAAQMD are compression-ignited engines, almost all of which are fueled with diesel oil. The BAAQMD inventory for these engines is based on the inventory developed by CARB for the stationary diesel ATCM. The CARB/BAAQMD inventory shows approximately 4100 diesel engines rated 25 hp or higher in the BAAQMD, of which approximately 3800 are used to drive backup generators or backup pumps. These are emergency standby engines which are exempt from the requirements of Reg 9, Rule 8. These 3800 engines account for about one-fourth of all NOx emissions from stationary sources under the District's jurisdiction. Many of the backup engines in the BAAQMD have been installed since 2000, when permits became mandatory for existing and new backup engines of at least 50 hp. New engines have been required to meet BACT NOx limits set at CARB's Tier 1 limit of 6.9 g/bhp-hr. Based on BAAQMD permit data, the CARB inventory appears to be fairly reliable in its population estimates for backup engines.

According to the CARB inventory, approximately 300 diesel engines are used to drive prime generators, prime pumps, or for other purposes. These engines account for approximately three-fourths of all NOx emissions (3.3 tons per day) from liquid-fueled engines and would be the primary target for controls. We believe this number greatly overstates the number of such engines in the Bay Area. This discrepancy arises because CARB, in determining how many engines should be classified as prime engines, relied on data from four air districts, including two (San Joaquin and South Coast) that have large numbers of these engines in operation in petroleum production, an activity of no significance in the Bay Area.

BAAQMD permit data shows that there are 495 engines flagged as non-standby engines. However, an examination of the data shows that some are, in fact, standby engines and a much larger number are used only intermittently. The permit data show that cities and counties have a large number of diesel generators that may run temporary lights for street repair, etc. Of the 495 non-standby engines, 70 of them have emissions of at least 1 pound of NOx per day, and only 47 of them have emissions of 10 pounds of NOx per day. These are the prime engines that are of concern. The collective emissions estimate for those engines of greater than one pound NOx per day is 1294 lbs per day, 0.65 tons/day, confirmation that the CARB inventory overstates the number of diesel-fired prime engines.

The California Air Resources Board adopted the stationary diesel ATCM on January 20, 2004. District imposed NOx controls on liquid-fueled engines may not produce emission reductions beyond those that are likely to be achieved through the implementation of the ATCM. If finalized by the Office of Administrative Law, the ATCM will result in the replacement of virtually all existing prime engines by 2011. All new engines will have to meet BACT both for particulate matter and for ozone precursors (VOC and NOx). Reductions of ozone precursors through the ATCM will likely exceed anything that can be achieved through retrofits on existing engines. The San Joaquin Valley Unified APCD dropped proposed requirements for diesel engines from its new Rule 4702 (adopted 8/21/03) for this reason. Due to these factors, further study of stationary IC

engines is recommended. If modification of existing District Regulation 9, Rule 8 is recommended avoid regulatory conflict with the ATCM, it will be included in the further study.

References

- California Air Resources Board. 2001. "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Stationary Spark-Ignited Internal Combustion Engines."
- California Air Resources Board. 2003. "Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Adoption of the Proposed Airborne Toxic Control Measure for Stationary Compression-Ignition Engines."
- Marr, L.C., Harley, R.A. 2002. "Spectral analysis of weekday-weekend differences in ambient ozone, nitrogen oxide, and non-methane hydrocarbon time series in California." *Atmospheric Environment* 36, 2327-2335.
- Sacramento Metropolitan AQMD. Rule 412.
- San Joaquin Unified APCD. 2003. "Final Draft Staff Report: Proposed Amendments to Rule 4701 (Internal Combustion Engines - Phase 1) and Rule 4702 (Internal Combustion Engines - Phase 2)"
- San Joaquin Unified APCD. Rules 4701 and 4702.
- South Coast AQMD. Rule 1110.2.
- Ventura County APCD. Rule 74.9.

FURTHER STUDY MEASURE FS 17: ENCOURAGE ALTERNATIVE DIESEL FUELS

Further Study Measure Description

Biodiesel

The District is currently conducting a feasibility study and pilot project to explore the potential air quality benefits of using biodiesel fuel in place of conventional petroleum diesel. The study will quantify the recoverable biodiesel feedstock from Bay Area sources, assess the environmental benefits (including air emission benefits) from these sources, identify production technology and costs, prepare a marketing plan, and identify obstacles and corresponding solutions to increasing biodiesel use in the Bay Area. The pilot project would demonstrate conversion of local feedstocks to biodiesel, use of the biodiesel in local fleets, and compare air pollutant emissions resulting from the use of the pilot project biodiesel to emissions from use of petroleum diesel in local fleets. While biodiesel has been shown to reduce emissions of particulates, reactive organic gases and toxic air contaminants, it can increase emissions of oxides of nitrogen. One important element of the District's feasibility study and pilot project is to explore ways to achieve emission reductions for oxides of nitrogen. The District will evaluate results of the study and project before determining whether and how to promote biodiesel use in the Bay Area.

Water/Diesel Emulsion

The ARB verified the emission reductions of Lubrizol's PuriNOx water/diesel emulsion in January 2001. In March 2004, the ARB released a report assessing the emission characteristics of PuriNOx. On average, emissions of NOx and PM were reduced 14% and 58 %, respectively, while hydrocarbon emissions increased by 87%. A significant

contribution to air quality from PuriNOx is in the reduction of diesel PM. ARB identified diesel PM as a toxic air contaminant that accounts for 70% of the toxic risk from all identified toxic air contaminants. While PuriNOx was shown to increase emissions of some toxic air contaminants, such as formaldehyde, acetaldehyde, BTEX, 1,3-butadiene, and some polycyclic hydrocarbons, the benefits from reducing diesel PM were significantly greater than the risks posed by the increase in other toxic air contaminants. The District will consider appropriate methods to promote the use of water/diesel emulsified fuels in the Bay Area.

FURTHER STUDY MEASURE FS 18: MITIGATION FEE PROGRAM FOR FEDERAL SOURCES

Further Study Measure Description

The regulation of emissions from ships, aircraft, trains, and off-road farm and construction equipment less than 175 hp is under exclusive federal jurisdiction and therefore pre-empted from State and local air district authority. Existing and projected Federal regulations for these pre-empted sources are not expected to achieve significant emission reductions in the near term. The Mitigation Fee Program, adopted into the South Coast AQMD's 2003 AQMP, but not yet implemented, would charge an air quality impact fee to sources pre-empted from State and local air district authority under the federal Clean Air Act. The proposed method of control would first require the EPA or other federal agencies to appropriate funds or enable collection of fees by the SCAQMD in lieu of controlling these sources through more stringent federal regulations. The SCAQMD has the authority to collect fees based on emissions under the Lewis Presley Air Quality Management Act. The SCAQMD would use the impact fees to fund and/or implement cost-effective emission reduction projects from both federal and non-federal sources. Implementation of this control measure by the SCAQMD may require additional legislation. The District will monitor SCAQMD's progress in implementing this program, and will evaluate the feasibility of implementing such a program in the Bay Area. The cost effectiveness of this measure in the Bay Area has not been determined. The ARB's emission inventory for ships, aircraft and trains in the Bay Area is estimated to be approximately 47.1 TPD of NOx and 9.3 TPD of ROG in 2005.

FURTHER STUDY MEASURE FS 19: INDIRECT SOURCE MITIGATION PROGRAM

Further Study Measure Description

Indirect sources are development projects that generate vehicle trips and thus indirectly cause air pollutant emissions. Health & Safety Code Section 40716 states that air districts may "...adopt and implement regulations to...reduce or mitigate emissions from indirect and areawide sources of air pollution," but also states, "Nothing in this section constitutes an infringement on the existing authority of counties and cities to plan or control land use, and nothing in this section provides or transfers new authority over such land use to a district."

Some small, single-county California air districts have implemented limited indirect source control requirements. Most California air districts currently limit their indirect source control activities to review of CEQA documents and, occasionally, technical guidance. No multi-county, regional air districts currently have ISC programs beyond CEQA commenting and limited technical assistance.

San Joaquin Valley Unified APCD staff is evaluating the option of adopting indirect source rules to reduce emissions of PM10 and ozone precursors. Rule 9510 would establish provisions for review of development projects and require implementation of mitigation measures and/or payment of fees. Rule 3180 would establish the fee schedule. SJVUAPCD conducted workshops in March 2004 on draft rules, and is continuing with the rule development process as of summer 2004.

The Air District currently implements various programs to reduce emissions from indirect sources, including: review and comment on CEQA documents; promotion of air quality elements in local plans; Transportation Fund for Clean Air grants for bicycle facilities, traffic calming, shuttles and other projects; cooperation with other regional agencies and stakeholder groups in the Smart Growth Strategy/Regional Livability Footprint project.

The Air District will evaluate ways to enhance these programs and further reduce emissions from indirect sources. The primary goal of the program would be to encourage land use development projects located and designed in such a way as to reduce vehicle use. Examples include infill development, mixed uses, increased densities near transit facilities, street design to encourage walking and cycling, etc. A secondary goal could potentially include providing funds (e.g., from air quality mitigation fees) for air quality mitigation measures such as transit improvements, shuttles, bicycle and pedestrian facilities, retrofitting or repowering heavy-duty diesel vehicles, etc. Potential program options that could be evaluated include Air District rules, enhanced outreach to local government, expanded CEQA review, or other programs. The Air District will monitor San Joaquin Valley Unified APCD's progress with developing indirect source rules and fees in order to determine the viability of such a program in the Bay Area.

FURTHER STUDY MEASURE FS 20: FREE TRANSIT ON SPARE THE AIR DAYS

Further Study Measure Description

Various transit districts around the United States have implemented free or reduced transit fares on ozone alert days. In the Bay Area, the Air District and MTC have implemented several pilot programs involving free transit service on Spare the Air (STA) days: a 1996 program with Santa Clara VTA, a 2003 and 2004 program with LAVTA, and a 2004 program with BART.

The 1996 VTA program involved distribution of VTA transit vouchers at participating worksites on STA days. The program was moderately successful, and also identified a number of enhancements to improve effectiveness, particularly the need for better marketing and more simplified implementation. Under the 2003 LAVTA program, all rides on all of LAVTA's Wheels routes were free on STA days. Survey data showed increases in ridership on STA days. The program is continuing in 2004.

Under the BART program, BART will provide free rides during the morning commute on the first five weekday Spare the Air days in 2004. \$2 million in CMAQ and TFCA funding has been committed to the project. This provides roughly \$312,000 per day for BART's costs and approximately \$450,000 for marketing and program evaluation.

In 2002, Air District staff calculated rough estimates of the costs and potential emission reductions of providing free rides on all Bay Area transit systems (excluding ferries) on STA days. Approximate costs were estimated to be \$1.1 million - \$1.3 million per day. Approximate emission reductions, assuming 5% and 15% increases in ridership, were as follows: ROG, 1.2 - 3.5 tpd; NOx, 1.5 - 4.6 tpd. MTC also evaluated such a program in 2002 and estimated costs to be \$1.5 million per day and emission reductions (15% ridership increase) to be: ROG, 0.7 tpd; NOx, 1 tpd. Thus, emission reductions from free transit on STA days could be significant (particularly for a TCM), but costs would be very high.

The Air District and MTC will study the feasibility of providing free transit service on STA days, focusing particularly on: 1) identifying the most cost-effective routes, and 2) identifying federal, State, regional, local and/or private funds that could potentially pay for the program. Since the cost of region-wide implementation is so high, pilot programs on selected transit systems are probably warranted prior to region-wide implementation. Further study would be needed to identify the most cost-effective transit systems for pilot programs. Other, more limited options that may be studied include reduced fares (rather than free fares) and free transfers between systems. Effective marketing programs for free transit on STA days will also need to be studied. The 2004 BART program will provide valuable information to evaluate this concept.

FURTHER STUDY MEASURE FS 21: EPISODIC MEASURES

Further Study Measure Description

Episodic measures are measures that are not implemented year-round, but instead are implemented only at times when pollution levels are expected to be highest. The Air District's Spare the Air program (STA), described in TCM 16, is a long-standing episodic measure aimed at discouraging polluting behavior by businesses, government agencies, and members of the public on days when weather conditions are conducive to high ozone levels.

The Air District and MTC have previously examined enhancements to episodic measures. The STA program has expanded significantly over the years. TCM 16 proposes further enhancements to the STA program. Further study measure 20 proposes to examine opportunities for and benefits of providing free transit service on STA days, possibly leading to expansion of several pilot programs the Air District and MTC have implemented in previous years.

The Air District and MTC will study additional potential episodic measures. Key considerations will include emission reduction potential, costs, technical and administrative viability, and public acceptability. Potential episodic measures that could be examined include, but are not limited to, the following:

Reduce high-speed travel on freeways. Cars and trucks produce higher emissions when traveling at high freeway speeds (e.g., above posted speed limits). TCM 16 proposes to emphasize (voluntary) compliance with freeway speed limits on STA days through STA advisories and outreach. MTC and the Air District could examine additional measures, such as expanded California Highway Patrol enforcement of freeway speed limits on STA days.

Limit use of pre-1981 vehicles. Older vehicles produce much more pollution than newer vehicles because they lack current emission control devices. The Air District's Vehicle Buy Back program offers owners of pre-1981 cars a cash incentive to voluntarily retire their vehicle, which is subsequently scrapped. TCM 16 proposes to place greater emphasis on discouraging use of pre-1981 vehicles in STA advisories and outreach. MTC and the Air District could examine additional measures to discourage use of pre-1981 vehicles on STA days, such as targeted outreach to owners of pre-1981 vehicles or providing incentives.

Reschedule processes at stationary sources. Some Air District rules limit polluting activity – such as repair and maintenance, cleaning, and other shutdowns of production equipment – at industrial facilities on STA days. Examples include prohibiting tank cleaning or process vessel depressurization at refineries on STA days. As Air District rules are adopted or amended, the District will continue to investigate such STA limitations to polluting activity that is infrequent and thus could be easily rescheduled.